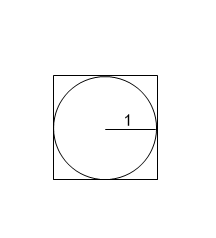
Consider a circle with a radius of 1 inscribing a square:

Background



The circle takes up of the square.

If we were to select a random point somewhere in the square, there would be a chance that the point is also in the circle. This is called theoretical probability: in theory, the probability of landing in the circle is the ratio of the area of the circle to the area of the square.

Suppose we randomly selected a point in the square 100 times, and of those 100 times, 76 times the point was also in the circle. This is called actual probability: in actuality, the probability of landing in the circle was .

As we select more random points, the actual probability approaches the theoretical probability. This is called the law of large numbers.

Therefore, as we randomly select more and more points within the square,

Multiplying both sides by 4:

We can use this to approximate Using the data from when we got 76 out of 100 points in the circle,

The randomness of your experiment and the number of times you perform the experiment directly affect the accuracy of your approximation.

You will use this idea to approximate by hand and with Microsoft Excel.

Approximating by hand

Activity

1. Draw a circle inscribing a square on paper.

2. Randomly select a point by dropping a penny in the square.

3. Record whether or not the penny landed in the circle. Obtain at least 50 results.

4. Use the following to approximate .

Approximating with Microsoft Excel

1. Open up Microsoft Excel. (Start → All Programs → Microsoft Office → Microsoft Excel 2007) What you see is called a spreadsheet. Each box is called a cell.

2. In cell A1, type =RAND(). This makes the content of cell A1 equal to a random number between 0 and 1. This will represent the x-coordinate of the random point.

Note: RAND() regenerates a number after each calculation. Don’t fret when the numbers change as you type in more formulas.

3. In cell B1, type =RAND(). This makes the content of cell B1 equal to a random number between 0 and 1. This will represent the y-coordinate of the random point.

4. In cell C1, type =SQRT(A1^2+B1^2). This makes the content of cell C1 equal to the distance from the point represented by cells A1 and B1 and the origin. Notice how the formula in C1 looks like the Pythagorean Theorem/Distance Formula.

5. In cell D1, type =IF(C1<1, 1, 0). This makes the content of cell D1 equal 1 if the distance calculated in C1 is less than 1, and 0 if it is not. In other words, this cell says 1 if the point is inside the circle, and 0 if it is not.

6. In cell E1, type =4\*SUM($D$1:D1)/COUNT($D$1:D1). This adds the number of times the point was inside the circle, divides it by the total number of trials, and multiplies it by 4. (The dollar signs ‘anchor’ that reference so that as you copy and paste the formulas, that cell doesn’t change. If you understand/enjoy this, consider taking Advanced Word & Excel from Mr. Shirey.)

7. Highlight cells A1, B1, C1, D1, and E1. Copy and paste the formulas you typed in by dragging the little black box located at the bottom right corner of cell E1 downward. (see below) As you paste more cells, the value in cell E gradually converges to .

